



<b>Title</b>	Evaluating the Sense of Belonging of Undergraduate Computing Students in the UK and Ireland
<b>Authors(s)</b>	Mooney, Catherine, McNeill, Fiona, Becker, Brett A.
<b>Publication date</b>	2023-09-07
<b>Publication information</b>	Mooney, Catherine, Fiona McNeill, and Brett A. Becker. "Evaluating the Sense of Belonging of Undergraduate Computing Students in the UK and Ireland." ACM, 2023.
<b>Publisher</b>	ACM
<b>Item record/more information</b>	<a href="http://hdl.handle.net/10197/25285">http://hdl.handle.net/10197/25285</a>
<b>Publisher's statement</b>	© 2023. This is the author's version of the work. It is posted here by permission of ACM for your personal use. Not for redistribution. The definitive version was published in Proceedings of the 2023 Conference on United Kingdom & Ireland Computing Education Research, Article No.: 34, (2023) <a href="http://doi.acm.org/10.1145/3610969.3611145">http://doi.acm.org/10.1145/3610969.3611145</a>
<b>Publisher's version (DOI)</b>	10.1145/3610969.3611145

Downloaded 2024-01-25T04:02:17Z

The UCD community has made this article openly available. Please share how this access benefits you. Your story matters! (@ucd\_oa)



© Some rights reserved. For more information

# Evaluating the Sense of Belonging of Undergraduate Computing Students in the UK and Ireland

Catherine Mooney  
catherine.mooney@ucd.ie  
University College Dublin  
Dublin, Ireland

Fiona McNeill  
f.j.mcneill@ed.ac.uk  
University of Edinburgh  
Edinburgh, Scotland

Brett A. Becker  
brett.becker@ucd.ie  
University College Dublin  
Dublin, Ireland

## ABSTRACT

Sense of Belonging, or belongingness, is an individual's personal conviction regarding their acceptance as a valued member within an academic community. The significance of student belongingness lies in its correlation with various outcomes including motivation, persistence, mental health and well-being. However, the experience of belongingness is subject to variations influenced by factors such as race/ethnicity and gender. Previous research has demonstrated notable statistical differences in the belongingness experienced by computing students who identify as women or as part of other minoritized groups.

During the COVID-19 pandemic, we observed a decline in belongingness among male and female students who do not identify as minoritised, while an increase was observed among women who identify as minoritised. Although students have returned to campus, current surveys reveal that the belongingness levels among men and women who do not identify as minoritised have not fully recovered to pre-pandemic levels. Additionally, a statistically significant decrease in belongingness is observed among men who identify as minoritised. This emphasizes the necessity for continued efforts to restore student belongingness to its pre-pandemic state and shed light on the positive impact that moving to a virtual environment appeared to have on sense of belonging of minoritised women.

We have been studying the sense of belonging of undergraduate students in the School of Computer Science at University College Dublin since 2017. We have recently extended this work across Ireland and Northern Ireland, and would now like to expand further into Scotland, Wales and England. We invite interested parties to participate in our RIPPA (Research in Practice Project Activity) at UKICER 2023.

## KEYWORDS

Belongingness; Inclusion; Sense of Belonging; Underrepresentation

### ACM Reference Format:

Catherine Mooney, Fiona McNeill, and Brett A. Becker. 2023. Evaluating the Sense of Belonging of Undergraduate Computing Students in the UK and Ireland. In *The United Kingdom and Ireland Computing Education Research (UKICER) conference (UKICER 2023)*, September 7–8, 2023, Swansea, Wales UK. ACM, New York, NY, USA, 2 pages. <https://doi.org/10.1145/3610969.3611145>

Permission to make digital or hard copies of part or all of this work for personal or classroom use is granted without fee provided that copies are not made or distributed for profit or commercial advantage and that copies bear this notice and the full citation on the first page. Copyrights for third-party components of this work must be honored. For all other uses, contact the owner/author(s).

UKICER 2023, September 7–8, 2023, Swansea, Wales UK

© 2023 Copyright held by the owner/author(s).

ACM ISBN 979-8-4007-0876-3/23/09.

<https://doi.org/10.1145/3610969.3611145>

## 1 INTRODUCTION

We have been monitoring our undergraduate computing students' sense of belonging for over six years, providing us with a unique opportunity to gauge changes before and during the COVID-19 pandemic, and since the return to campus. Our survey instrument was approved by the University College Dublin (UCD) Human Research Ethics Committee (numbers LS-17-30-Mooney, LS-19-12-Mooney, LS-21-62-Mooney). Our school has one undergraduate degree (BSc in Computer Science) with a total of approximately 450 students fairly evenly distributed across four years, and all students were invited to take part. Responses were gathered via a Google form advertised on email and student social media groups.

The survey questions were adapted from the "Math Sense of Belonging Scale" [1] containing 18 positively framed questions (e.g. I feel accepted/I feel respected/etc.) and 12 negatively-framed questions (e.g. I feel excluded/I feel disregarded/etc.). All items were preceded by "When I am in a computer science setting...". For each item, participants rated their agreement on an 8-point Likert scale (1 strongly disagree → 8 strongly agree). *Belongingness* was measured as the sum of positively framed question scores minus the sum of negatively-framed question scores.

In addition to these "Sense of Belonging" questions we also asked questions regarding prior experience, confidence in maths ability, inherent ability, problem solving, social interaction with other students and university club/society membership. Students were asked to self describe their gender, race/ethnicity and whether they identified as being minoritized or not, and if so, what minoritized group they identified with. Finally, we asked two open ended questions: "Is there anything that has positively or negatively impacted your Sense of Belonging?" and "Are there ways that you think that Sense of Belonging might be improved?"

## 2 RESULTS TO DATE

Changes in belongingness between 2017 and 2022 have been discussed in prior work [3–7]. Briefly, pre-COVID, women identifying as being minoritized had the lowest belongingness of all students (statistically significant) [3, 4]. However, this increased when teaching moved online and dropped again after returning to campus [5–7]. Figure 1 shows that women who do not identify as being minoritized had very similar belongingness to non-minoritized men, although they have slightly diverged recently. Most recently, and concerning, is a dramatic and statistically significant decrease in the belongingness of men who identify as minoritized (N=15, M=13, SD=36) compared to those who do not (N=30, M=41, SD=38),  $t(27)=2.25$ ,  $p=.033$  (Welch's t-test). Men cited

race/ethnicity, LGBTQIA+, dis/ability, age, and socio-economic status as reasons for identifying as minoritized. A number of men identified more than one factor.

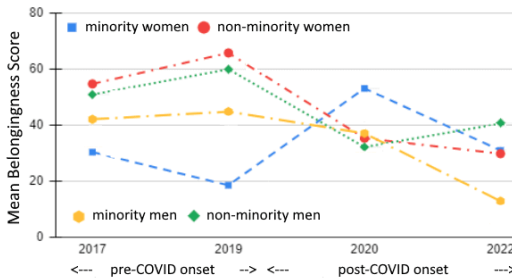


Figure 1: Changes in belongingness from 2017 to 2022.

Sense of belonging has also been monitored at the University of Edinburgh (UoE) during Covid and during the last academic year. In this case, survey questions were adapted from the student computer science attitude survey: CS principles [2]. The results are not directly comparable with those from UCD because of survey differences, but provide some similar insights into the sense of belonging of UoE students.

### 3 RIPPA PROJECT OUTLINE

#### 3.1 Objectives:

- (1) Evaluate undergraduate students' sense of belonging
- (2) Determine what affects students' sense of belonging
- (3) Develop a set of recommendations based on the results of the data analysis
- (4) Implement the recommendations to enhance students' sense of belonging
- (5) Measure the impact of these initiatives

#### 3.2 Research Questions

**RQ1:** What are the main factors that impact computing students' sense of belonging?

**RQ2:** What comprehensive recommendations can facilitate strategic changes aimed at enhancing students' sense of belonging?

**RQ3:** In evaluating the impacts and outcomes of these recommendations with diverse cohorts over a multi-year study, how have these recommendations impacted students' sense of belonging?

### 4 RIPPA SCHEDULE

The RIPPA will launch with a start-up workshop held during a session at UKICER 2023. That workshop will consist of a series of presentations, small breakout group activities, and large group discussions. The workshop agenda is as follows:

- (1) Introductions
- (2) Evaluating Sense of Belonging
  - What do we know so far?
  - What are the current gaps in the literature?
  - Breakout group activity
  - Large group discussion
- (3) Sense of Belonging Survey
  - Review survey questions and information sheets, etc.
  - Review ethics applications

- Breakout group activity
  - Large group discussion
- (4) Wrap-Up: Looking to the future
- Discussion of future research steps
  - Discussion of opportunities for future research collaboration

Following the workshop, participants will be invited to contribute to the RIPPA by running empirical studies to collect research data from undergraduate students in their institutions. Those interested in doing so will attend a follow-up Zoom meeting in which we provide detailed instructions and guidelines for applying for ethical approval, running surveys, and collecting research data in Spring 2024. We anticipate that this meeting will be held in October 2023.

In Summer 2024, we will hold an interim Zoom workshop where participants will present and discuss results from surveys run during the 2023-24 academic year. Based on these, we will decide as a group how to proceed with writing up the results as one or more multi-institutional studies, and where to submit the paper(s).

In August of 2024, we will hold a capstone Zoom workshop in which we discuss the submission of a final version of one or more research papers. At this point, we will make any final plans necessary to bring the paper(s) to completion, with the goal of submitting the first paper by the end of 2024.

### 5 CONCLUSION

We hope that over time we will observe positive impacts due to interventions designed to increase the belongingness of all students, and that ultimately we can eradicate the negative impact that minoritisation and gender identity are having on sense of belonging. We believe that our results may be of interest to other computing educators and departments in similar contexts.

### REFERENCES

- [1] Catherine Good, Aneeta Rattan, and Carol S Dweck. 2012. Why Do Women Opt Out? Sense of Belonging and Women's Representation in Mathematics. *Journal of Personality and Social Psychology* 102, 4 (2012), 700.
- [2] K. C. Haynie and S. Packman. 2017. Student Computer Science Attitude Survey: CS Principles. (2017). <https://csedresearch.wpengine.com/resources/evaluationinstruments/tool/?id=156>
- [3] Catherine Mooney, Anna Antoniad, Ioannis Karvelas, Lana Salmon, and Brett A. Becker. 2020. Exploring Sense of Belonging in Computer Science Students. In *Proceedings of the 2020 ACM Conference on Innovation and Technology in Computer Science Education* (Trondheim, Norway) (ITiCSE '20). ACM, NY, NY, USA, 563. <https://doi.org/10.1145/3341525.3393974>
- [4] Catherine Mooney and Brett A. Becker. 2020. Sense of Belonging: The Intersectionality of Self-Identified Minority Status and Gender in Undergraduate Computer Science Students. In *United Kingdom & Ireland Computing Education Research Conference*. (Glasgow, United Kingdom) (UKICER '20). ACM, NY, NY, USA, 24–30. <https://doi.org/10.1145/3416465.3416476>
- [5] Catherine Mooney and Brett A. Becker. 2021. Investigating the Impact of the COVID-19 Pandemic on Computing Students' Sense of Belonging. In *52nd ACM Technical Symposium on Computer Science Education* (Virtual Event, USA) (SIGCSE '21). ACM, NY, NY, USA, 612–618. <https://doi.org/10.1145/3408877.3432407>
- [6] Shamima Nasrin Runa, Anna Markella Antoniad, Brett A. Becker, and Catherine Mooney. 2023. Student Sense of Belonging: The Role of Gender Identity and Minoritisation in Computing and Other Sciences. In *Proceedings of the 25th Australasian Computing Education Conference* (Melbourne, VIC, Australia) (ACE '23). ACM, NY, NY, USA, 87–96. <https://doi.org/10.1145/3576123.3576133>
- [7] Shamima Nasrin Runa, Brett A. Becker, and Catherine Mooney. 2022. Variations in Sense of Belonging in Undergraduate Computing Students Through the COVID-19 Pandemic. In *Proceedings of the 2022 Conference on United Kingdom & Ireland Computing Education Research* (Dublin, Ireland) (UKICER '22). ACM, NY, NY, USA, Article 18, 1 pages. <https://doi.org/10.1145/3555009.3555029>